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ABSTRACT

This study compared the mean scores of the final examinations given to 2 populations of junior college students taking College Algebra by 2 instructional methods. The control group received instruction by the traditional approach of lectures and classroom discussion; while the experimental group had their lectures and discussions supplemented by multimedia lessons which could be taken in the college library outside of the regularly scheduled class period on a voluntary basis by those students that felt they needed extra instruction. A statistical treatment of the data using the T-test showed a significant difference in the achievement of the 2 groups. The experimental group's achievement was significantly higher than the control group's achievement at the 1% level of confidence. (Author)

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A STUDY OF THE EFFECTIVENESS OF UTILIZING INDIVIDUALIZED FILMSTRIPS, TAPES AND COORDINATED WORKSHEETS AS INSTRUCTIONAL TOOLS FOR BEGINNING COLLEGE MATHEMATICS CLASSES

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Mt. San Jacinto College

Gilman Hot Springs, California

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Richard E. Banister
Dean of Academic Instruction

ABSTRACT

This study compared the mean scores of the final examinations given to two populations of junior college students taking College Algebra by two instructional methods. The control group received instruction by the traditional approach of lectures and classroom discussion; while the experimental group had their lectures and discussions supplemented by multimedia lessons which could be taken in the college library outside of the regularly scheduled class period on a voluntary basis by those students that felt they needed extra instruction. A statistical treatment of the data using the T-test showed a significant difference in the achievement of the two groups. The experimental group's achievement was significantly higher than the control group's achievement at the 1% level of confidence.

Chapter 1

INTRODUCTION

In the last decade, great strides have been made in the development of programmed instruction, audio-visual techniques, and educational systems. With the introduction of federal money into curriculum development projects, many fields have improved their curricular offerings. This has been evident in the fields of physics, chemistry, mathematics, linguistics, geography, earth sciences, and social sciences. Significant amounts of money have been used in these areas to pull together curricular development teams composed of learning theorists, subject matter specialists, and educators. Most of this development has taken place, however, in the elementary and secondary schools. Little innovative development has occurred in higher education.

In recent years student demonstrations and student dissent in general has focused in some institutions on the problems of obsolesence in both curriculum and instructional methods in higher education. Many of the grievances of students in institutions of higher education have centered about their inability to have adequate contact with their instructors because these instructors were either at the head of a large lecture class or were absent from class and had turned it over to graduate assistants. Other grievances included the lack of humaneness in the large colleges and universities where students were treated as IBM numbers instead of individuals. Students have often grieved because of poor instructional methods in higher education and of the inability of some of the professors to convey their subject matter to the students.

Mt. San Jacinto recognized that these were the kinds of problems that community colleges interested in attracting students and holding students would have to overcome. In the winter of 1965, Mt. San Jacinto offered a mid-year workshop for its faculty that included several presentations on the writing of behavioral objectives and the utilization of multimedia techniques to teach toward those objectives. Several staff members showed an interest in this approach and more in-service training was provided for those interested faculty members to encourage them to develop behavioral objectives and multimedia systems as well as to show them how to do it. Several multimedia programs were initiated and implemented into the regular curricular offerings of the college during the 1967-68 school year.

Milo P. Johnson, Superintendent-President, recommended to the Board of Trustees of the college, that they pass a resolution encouraging instructors to use behavioral objectives and multimedia where feasible and encouraging the administration to recruit new faculty members who would be willing and able to teach in this manner. In the year that followed, several courses were presented by multimedia, including American history to 1865, typing, shorthand, health education, and auto mechanics. During the summer of 1968, teachers were employed to work on multimedia systems for auto mechanics, freshman composition, public speech, and health education. Beginning with the funding of this project, the course College Algebra was put into multimedia format.

A Rationale For Multimedia Instructional Systems

Contrary to many concepts of multimedia instructional systems, Mt. San Jacinto's multimedia system does not attempt to individualize instruction by feeding the student a steady diet of programmed material. Mt. San Jacinto has gone to the use of semi-automated tutorial systems as an integral part of numerous college courses in order to: (1) better utilize instructor time, (2) provide an opportunity for instructors to meet with seminar groups, and (3) to improve the quality of presentations of material to students.

In the traditional schedule at a typical college, an instructor will meet his classes two, three, or four times a week in a lecture situation. Some courses provide laboratories to supplement lectures, but most classes do not have a lab. Under such a schedule, the instructor meets his classes regularly in a large group where he stands at the front of the room and talks to the class. If the group is thirty or less, there may be some opportunity for the class to ask questions; however, in most institutions of higher learning, enrollments in classes have reached a point where two-way communication is difficult if not impossible.

Mt. San Jacinto College has attempted to have the instructor's time utilized in a different manner by putting his lectures in a semi-programmed format and having them recorded on tape and filmstrips for future use. The idea is to invest considerable time in program development and hope that this program can be used for several years in several sections of a given course. Students taking courses utilizing multimedia as an integral part of the course do not attend three of four lectures a week; instead, they will take one or two classes a week in the college library where they will receive the lectures in a semi-programmed format by a tape which is illustrated by a filmstrip.

When students meet with instructors under this system, they generally have two kinds of activities. One activity is a class held in a large lecture hall or auditorium where introductory lectures can be given, tests administered, or motion picture films viewed by the group. The other weekly activity is a discussion with fellow students and the instructor in small seminar groups. These groups vary from ten to twenty students, most of them having around fifteen in attendance.

In Mt. San Jacinto's multimedia program, teachers spent their time in program development (usually during the summer), small group discussions and large group presentations. Student time is spent in attending small group seminars, large group sessions, and individualized study in the school library.

Most college teachers, teaching a full load, have little time for course development unless they develop the courses that they are to teach on their own time in the summer, in the evenings, or during weekends. Mt. San Jacinto College has provided many of its teachers an opportunity to work during the summer months on the development of curriculum for their particular courses. Teachers have been able to design new courses from the group up. Many of them have utilized behavioral objectives in establishing the parameters for their courses. They have also laid out the courses week by week, activity by activity to design the most effective teaching-learning system possible.

Equipment For Multimedia

Equipment requirements for multimedia will depend, of course, upon the type of media to be used in the program. It could include closed circuit television, open circuit television, motion picture, overhead projectors, teaching machines, programmed textbooks, library materials, art prints, study prints, or many other kinds of equipment including laboratory equipment. The administration and staff at Mt. San Jacinto made a thorough study of the kinds of equipment available for multimedia and the kinds of media that were within the financial reach of the institution. It was decided that the filmstrip, tape and student response sheet were the best and most practical media to use at this particular institution.

Study booths were designed and built to be housed in the library and in some classrooms. Tape recorders and projectors were purchased and placed in the study booths. A tape duplicating system was established by hooking fifteen slave tape recorders to one master tape recorder. This allowed quick duplication of fifteen copies of each lesson. A production unit was established employing artists, and photographers to manufacture filmstrips. Sound technicians were also employed to cut master tapes and duplicate copies. The college clerical pool produces the student response sheets as well as other printed forms required in the courses. Textbooks, library materials and other types of audio-visual and laboratory equipment normally found on college campuses are also utilized in the system.

Need For An Experimental Project

Although Mt. San Jacinto College had successfully taught several college courses by multimedia, the college had not used multimedia in the mathematics department. It was decided that the college should attempt to teach mathematics by multimedia on an experimental basis to find out the feasibility of this type of teaching for math and the efficiency and effectiveness of this approach.

College algebra was the course which was selected for the experiment. A grant from the U. S. Office of Education was applied for to finance the development of the course in college algebra and the testing of this course on two populations. One using the traditional approach of instruction and the other using the traditional approach plus multimedia lessons. It was felt that if students could receive multimedia lessons to supplement their classroom instruction that those students having difficulty achieving in the classroom or missing class for illness or other reasons could supplement their regular instruction by multimedia thus improving their understanding and retention of the subject matter. Because the math teachers at Mt. San Jacinto College had no previous experience in developing multimedia lessons it was felt that the most practical approach would be to develop supplemental materials for the regular classroom. It was felt that if these materials worked to supplement lectures, they could be utilized at a later time to substitute for the classroom instruction, thus freeing the teacher of much of the lecture load that he would normally carry in his schedule. Upon the approval of the project, two mathematics teachers were employed to write multimedia lessons in mathematics.

Chapter II

METHODS OF RESEARCH

This research project involved the evening college algebra course taught during the first semester of the 1968-69 school year and the same course taught in the evenings the first semester of the 1969-70 school year. The first semester's program was used as the experimental group. Both groups were comprised of students who randomly elected to enroll in this course.

Two math instructors, Sidney Alkire and Victor Burgard developed the multimedia lessons during the 1968-69 school year and the summer that followed in '69. Mr. Burgard taught both the control group and the experimental group. Identical tests were given to each group. The two final examinations were used to evaluate the success of the program for this study.

Before the experimental group could be run, the multimedia lessons had to be written. This involved the identification of topics to be covered by the program, the writing of scripts teaching towards those topics, the illustration of each script, the development of problems for the students to solve after viewing the lesson, and the development of the test instrument to measure achievement.

The control group attended the course the first fall of the program. They received their instruction through classroom lectures which were often followed by discussion. This approach is the traditional approach which has been used for many years by mathematics teachers. The experimental group received the identical classroom instruction plus their classroom instruction was supplemented with multimedia lessons which could be taken in the school library on a voluntary basis. Persons taking multimedia lessons tended to be those persons who missed class because of illness or other reasons and those persons who did not fully understand the instructor's lecture. The multimedia lessons were of particular help to those students who had not had mathematics recently and who had to spend a great deal of time being exposed to the lecture and the content in order to grasp the concepts.

Students using the multimedia lessons did so in the college library anytime during the school day or evening. This allowed them to schedule themselves into the library at their convenience to work as long or as short a time as they needed. Persons using the multimedia checked it out from the librarian and took it to one of the 80 carrels equipped with filmstrip projectors and tape recorders. The flexibility of this equipment allowed students who were unable to understand the concepts the first time to back up a segment of the tape and filmstrip and to receive the instruction as many times as necessary for them to understand the concepts presented.

The Populations

The populations were very similar in size and sex. The control group had 25 members, 6 being female and 19 male. The experimental group had 27 members, 7 being female and 20 male. Both populations included high school

honor students, teenage college students and adult students. The ability of these students range from students having recently taken prerequisite math courses to students who had not had prerequisite high school math courses for many years, if ever.

The control group attended the first semester of the 1968-69 school year in the evening class scheduled for Thursday evenings. The experimental group attended the first semester of the 1969-70 school year at an evening class also scheduled on Thursday evenings. It was determined by the instructor who taught both classes that the groups were comparable in ability and in range of diversity. He also felt that because of this similarity, the groups were ideal for the type of research that this project was designed to carry out.

Evaluation Instrument

The evaluation instrument used in this study was composed of the final examination for the course. This examination contained objective questions and was administered to each group in a three hour period of time at the last meeting of the class. The final examination was a comprehensive examination covering all of the topics discussed during the semester. Only the final examination was used as an instrument because the instructor had no control over which students used which multimedia lessons during the semester. A survey indicated that at least 50% of the students used the multimedia material. The instructor also reported that several of the students who had not had math instruction for many years were able to get satisfactory grades because they were able to review on multimedia the concepts needed to satisfactorily complete the course. One student taking the course during the experimental session had failed the course previously but received B as a final grade in his second time around. He attributed his success to the use of the multimedia to supplement classroom instruction.

Statistical Treatment of Data

In the statistical treatment of data the T-test was the statistical design used in this research project. A null hypothesis was formulated that there was no difference between the experimental group and control group with reference to the mean score of each group's test. This null hypothesis was applied to the final test administered to each group.

Chapter III

FINDINGS AND ANALYSIS

Table I presents the raw scores for the final examination for both the control and experimental group. Table II presents the computations that were used to arrive at a T-value.

Presentation of Findings

The statistical treatment of the data in this particular study led the researchers to the rejection of the null hypothesis. There was a significant difference between the mean scores of the control group and the experimental group. The experimental group did significantly better on their final examination than did the control group. The t-scores were at the 1% level of confidence.

TABLE I
FINAL TEST RAW SCORES
FOR CONTROL AND EXPERIMENTAL
GROUPS

CONTROL	EXPERIMENTAL
88	96
88	94
88	92
88	90
86	90
84	90
84	90
82	90
82	88
80	87
80	86
78	86
75	86
74	86
74	86
68	84
66	84
66	84
64	82
64	80
62	80
60	80
52	78
20	78
2	72
	72
	70

TABLE II
T-TEST COMPUTATIONS FOR
FINAL TEST

CONTROL

Me = 70.2

σc = 20.27

Nc = 25

σm_c = 4.14

EXPERIMENTAL

Me = 84.5

σe = 6.48

Ne = 27

σm_e = 1.27

σ diff = 4.33

t = 3.30

df = 50

t-value = 49.94

level of confidence = .1% well within 1%

Chapter IV

CONCLUSIONS AND RECOMMENDATIONS

This study, though limited to two groups of less than 30, demonstrates that a multimedia system utilizing tapes and filmstrips is an effective means of supplementing the regular traditional mathematics program. Although it was not a part of the research design, an additional bit of information is that the control group had two F's and three D's as a final grade for the course while the experimental group had no D's or F's. It appears that the multimedia lessons which supplemented the traditional approach to the teaching of mathematics allowed those students who were having difficulty in achieving in the regular program to review the concepts and to learn them, thus assuring their success in the course. Some students who were having difficulty made extensive use of the multimedia materials to supplement the classroom instruction. This material was also used to replace the classroom instruction for those students that missed classes because of illness.

Recommendations

This research project demonstrates that the use of a multimedia system to supplement the traditional mathematics instructional program has a significant effect upon the success or failure of the students in the program. It also points up the need for further study in the use of multimedia in mathematics. Now that we have developed multimedia instructional lessons which successfully teach math concepts, further study should be carried out to see if these kinds of lessons can be used to replace live classroom instruction. This is the next step that should be explored, for if multimedia instructional materials can replace live lectures by the instructor, a significant amount of instructor time can be saved and more students handled for the same expenditure of funds. This involves the identification of topics to be covered by the program, the writing of scripts teaching towards those topics, the illustration of each script, the development of problems for the student to solve after viewing the lesson, and the development of a test instrument to measure achievement.